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Microbiological removal of engine oils from natural water using plant-derived sorbents

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Abstract

The ongoing pollution of water resources with a variety of lubricating oils, the insufficiently developed methods of purification of natural and waste water poses the problem of finding ways to restore the natural qualities of the environment. The authors see a solution to this problem in the wide use of activity of individual associations of oil-oxidizing microorganisms (OOM) in combination with the plant-derived sorbents (buckwheat, oat, wheat and barley husk), which allows deep controlled oxidation of these contaminants down to CO2 and H2O. It was found that the multi-species OOM communities take more active part in biodegradation of mineral, semi-synthetic and synthetic oils, than those with the limited species composition. The growth, development and activity in the oil biodegradation is determined by the nature of the contamination. The population growth maxima lie between 5 and 14 days, and decrease to 2 to 6 hours under the influence of sorbents This affects the oil consumption amount, which is 1.7-3.5 times higher under the influence of the sorbents, and 3-7.2 times higher in the control. The first by the efficiency of water cleaning from lubricating oils by the association of nine species of OOM is barley husk, then buckwheat husk, then oat and wheat husk (laboratory experiment); barley, oat, buckwheat and wheat in field experiments (close to natural water bodies) with the particle size of 0.018 mm and 0.036 and at a concentration of 50 mg/l. An important factor in the intensification of water purification from oil with OOM is the introduction of sorbents (type, combination and ratio of the substrate to the bacteria) in the water body. It was found that the maximum purifying effect (32.2-45.4%) 9-12 days prior to the contact is achieved with the introduction of sorbents and OOM in an amount of 102·106-106·106 cells/ml, mixed together in the form of a suspension, in contaminated water. This allows achieving a uniform distribution of ingredients that positively affects the biotransformation processes of the contaminants. Upon spraying sorbents on the oil film surface we observe the formation of separate lumps, slowly decomposing and dispersing throughout the area. This negatively affects the immobilization of the OOM cells in sorbents and slows down the process of water purification.

Keywords

And synthetic oils, Biodegradation, Consortium, Hydrocarbon-oxidizing microorganisms, Plant-derived sorbents, Semi-synthetic, The controlled biodegradation of lubricating oils, The mineral